

TITLE OF THE INVENTION

**SYSTEM AND METHOD FOR NETWORK ADDRESS TRANSLATION
AND SESSION MANAGEMENT**

CLAIM OF PRIORITY

[0001] This application makes reference to, incorporates the same herein, and claims all benefits accruing under 35 U.S.C. §119 from an application for *SYSTEM AND METHOD FOR CONTROLLING NETWORK ADDRESS TRANSLATION AND SESSION* earlier filed in the Korean Intellectual Property Office on 14 February 2003 and there duly assigned Serial No. 2003-9512.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a system and method for the NAT (Network Address Translation) and a session management, for performing address translation and distributing a call to a plurality of call agents with respect to a SIP (Session Initiation Protocol) message in an NAT system, by applying NAT concept to a SIP call initiated at the external public network or the local network in a packet exchange system for processing a SIP call.

Description of the Related Art

[0003] Up to now, the Internet has been developing mainly in the field of data traffic such as an

1 e-mail (electronic mail) or web and with the advent of application requiring transfer of real-time
2 traffic such as distant learning, teleconference, the Internet is now progressing to the trend of
3 accepting the real time traffic such as voice and image.

4 **[0004]** Transmission of audio and video data is performed with use of a UDP (User Datagram
5 Protocol) or IP multicast, not a reliable transport protocol such as a TCP (Transport Control
6 Protocol), for real-time transport to a plurality of attendants.

7 **[0005]** H.323 protocol is the "Packet-based Multimedia Communication Systems" and is the
8 standard recommendations of a video conference system for a variety of packet exchange networks
9 represented by the Internet

10 **[0006]** The H.323 system does not retransmit a damaged or lost packet upon transmission, but
11 instead, uses a method of dynamically controlling transmission rate or of recovering the packet lost
12 during the conference by monitoring lost data, thereby putting an emphasis on real-time property
13 rather than reliability.

14 **[0007]** In the meantime, the SIP (Session Initiation Protocol) system operating on the basis of the
15 IP (Internet Protocol) consists of a user agent and a network server. The user agent is a terminal,
16 performing the same function as the terminal of the H.323, and generally functioning as a UAC
17 (User Agent Client) for requesting a call and a UAS (User Agent Server) for responding to a
18 requested call.

19 **[0008]** The SIP makes use of the existing Internet servers such as the existing Name Server,
20 Authentication server as they are, referring to overall procedures regarding a call session
21 establishment, maintenance, release, management for the Internet phone. The SIP is a protocol based

1 on a client-server, and develops in such form that a call trying part calls a counterpart in order to get
2 the counterpart to attend a session. Therefore, the SIP provides functions such as a user position
3 locating, session establishing, session negotiating, session participant managing and a Call Feature
4 Invocation including Hold, Transfer, Mute. Also, for processing a call, the SIP uses a protocol based
5 on a text having syntax and semantics similar to HTTP (Hyper Text Transfer Protocol).

6 **[0009]** In the NAT system applying the SIP of the related art, a call agent, which is one SIP call
7 controller, plays a role of mediating a call between a calling SIP terminal and a called SIP terminal.

8 **[0010]** Therefore, SIP traffic swiftly processed by one SIP call agent is limited and if many SIP
9 calls are tried simultaneously to one call agent, traffic processed by the call agent become limited
10 even more, so that swift processing of a SIP call gets difficult.

11 **[0011]** In order to resolve such problem, a NAT system having a plurality of SIP call agents for
12 processing much more SIP traffic simultaneously, for distributing a call to a plurality of these SIP
13 call agents, is required.

14 **[0012]** The NAT system performs a function of translating a network address. Namely, the NAT
15 system transmits an IP packet received from the public network, to the local network, translating a
16 network address in order to transmit the IP packet received from the local network, to the public
17 network.

18 **[0013]** By such function, the Internet could be accessed at a node where an individual address is
19 not assigned. Also, specific TCP/IP (Transfer Control Protocol/Internet Protocol) application could
20 be used through translation for protocol of TCP/IP transmission layer or application layer.

SUMMARY OF THE INVENTION

[0014] It is, therefore, an object of the present invention to provide a system and method for address translation and session management in a network address translation system capable of performing address translation and swiftly distributing a call to a plurality of call agents with respect to a SIP message in the NAT system, applying NAT concept to a SIP call initiated at the external public network or the local network in a packet switching system for processing a SIP call.

[0015] It is another object of the present invention to provide a system and method for network address translation and session management according to the present invention, that could include more than one call agent for a packet exchange system, by applying the NAT using the SIP to a packet exchange system for supporting VoIP(Voice over Internet Protocol) using the SIP in the packet network, and thus processing much more traffic.

[0016] It is yet another object to provide a system and method for network address translation and session management according to the present invention that gives a private network address to the call agents in the local network, giving a public network address to the NAT, thereby properly distributing the SIP call input to the NAT from the external network, to the call agents in a plurality of local networks.

[0017] It is still another object to provide one call agent connected through the first Call ID processes a call from its beginning to its ending, so that the call agents in the local network could process much more calls.

[0018] It is another object to provide a system and method for address translation and session management in a network address translation system capable of easy and inexpensive

1 implementation while having increased efficiency.

2 **[0019]** To achieve the above and other objects, the present invention includes a plurality of call
3 agents (constituting the local network) and interfacing a plurality of SIP call agents with the NAT.
4 This NAT uniformly distributes a SIP call input from the outside, to the SIP call agents in its inside.

5 **[0020]** Namely, one aspect of a “system for network address translation and session management”
6 of the present invention to achieve the above object, includes: a calling SIP terminal connected to
7 an external public network; a network address translation block (NAT block) for receiving a SIP
8 message transmitted from the calling SIP terminal, performing address translation and session
9 management for the calling SIP terminal of an internal SIP; a plurality of call agents constituting a
10 local network with the NAT block, for being responsible for call process.

11 **[0021]** Another aspect of a “system for network address translation and session management” of
12 the present invention, includes: a plurality of call agents responsible for call process; a network
13 address translation block (NAT block) connected to a plurality of the call agents through a local
14 network, for performing address translation and session management for a SIP message received
15 from the call agents existing in a local network by interfacing an external network; a called SIP
16 terminal connected to the NAT block and an external public network.

17 **[0022]** In the meantime, one aspect of a “method for network address translation and session
18 management” of the present invention, includes: receiving a call establishment request message
19 generated from a calling SIP terminal connected to an external public network, extracting a public
20 network address from the received call establishment request message, storing the same; selecting
21 a specific call agent among a plurality of call agents, storing a communication path for the specific

1 call agent in session information of a relevant call after the above step; and distributing traffic by
2 transmitting a SIP message transmitted from the calling SIP terminal, to a selected call agent only,
3 using information stored in a session of the relevant call.

4 **[0023]** Selection of a specific call agent in the above, is made by selecting different one call agent
5 among a plurality of call agents for a call establishment request message generated from a calling
6 SIP terminal.

7 **[0024]** Also, aspect of a “method for network address translation and session management” of the
8 present invention, includes: receiving a call establishment request message generated from a plurality
9 of call agents connected through a local network, extracting a public network address from the
10 received call establishment request message, storing the same; storing a communication path for a
11 specific call agent among a plurality of call agents in session information of a relevant call after the
12 above step; and distributing traffic by transmitting a SIP message transmitted from the specific call
13 agent, to a selected calling SIP terminal only, using information stored in a session of the relevant
14 call. Here, the calling SIP terminal transmits and receives a SIP message only through a different one
15 call agent among a plurality of call agents.

16 **BRIEF DESCRIPTION OF THE DRAWINGS**

17 **[0025]** A more complete appreciation of the invention, and many of the attendant advantages
18 thereof, will be readily apparent as the same becomes better understood by reference to the following
19 detailed description when considered in conjunction with the accompanying drawings in which like
20 reference symbols indicate the same or similar components, wherein:

1 **[0026]** Fig.1 is a drawing showing procedure for a SIP call process upon call mediation by a call
2 agent (SIP proxy server) in the NAT system;

3 **[0027]** Fig.2 is a drawing showing procedure for a call process in case that a call originates from
4 a SIP client in a system and method for network address translation and session management
5 according to the present invention; and

6 **[0028]** Fig.3 is a drawing showing procedure for a call process in case that a call terminates to a
7 SIP client in a system and method for network address translation and session management
8 according to the present invention.

9 **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

10 **[0029]** A preferred embodiment of a system and method thereof for network address translation
11 and session management according to the present invention will now be described with reference
12 to the accompanying drawings. The matters defined in the description such as a detailed construction
13 and elements are no more than providing to assist in a comprehensive understanding of the
14 invention. Thus, it is apparent that the present invention can be carried out without those defined
15 matters. Also, well-known functions or constructions are not described in detail since they would
16 obscure the invention in unnecessary detail.

17 **[0030]** Fig.1 is a drawing showing procedure for a SIP call process upon call mediation by a call
18 agent (SIP proxy server) in the NAT system.

19 **[0031]** As shown in Fig.1, a call agent 20, which is one SIP call controller, plays a role of
20 mediating a call between a calling SIP terminal 10 and a called SIP terminal 30.

1 **[0032]** A procedure of a call process upon mediation of a call will be described. If a calling SIP
2 terminal 10 transmits a communication request message (INVITE) to a call agent 20 (step 41), a call
3 agent 20 that receives a communication request message transmits the received communication
4 request message (INVITE) to a called SIP terminal 30 (step 42).

5 **[0033]** Subsequently, the called SIP terminal 30 transmits a message (100 Trying) for informing
6 the processing of a call, to the call agent 20 (step 43), and the call agent 20 which receives that
7 message transmits a processing message for a call, to the calling SIP terminal 10 (step 44).

8 **[0034]** Also, the called SIP terminal 30 transmits a calling signal (180 Ringing) to the call agent
9 20 (step 45) and the call agent 20 transmits a calling signal to the calling SIP terminal 10 (step 46).

10 **[0035]** After that, the called SIP terminal 30 transmits a message (200 OK) for accepting a call
11 establishment request, to a call agent 20 (step 47) and the call agent 20 transmits a message (200 OK)
12 for accepting a call establishment request to the calling SIP terminal 10 (step 48).

13 **[0036]** Subsequently, the calling SIP terminal 10 delivers an acknowledgement message ACK
14 with respect to the response, to the call agent 20 (step 49), and the call agent 20 delivers an
15 acknowledgement message ACK with respect to the response, to the called SIP terminal 30, so that
16 a call is established (step 50).

17 **[0037]** Subsequently, the calling SIP terminal 10 and the called SIP terminal 30 performs a
18 communication (step 51).

19 **[0038]** After that, if communication is terminated, the calling SIP terminal 10 delivers a message
20 BYE for requesting connection termination, to the call agent (step 52), and the call agent 20 delivers
21 a message BYE for requesting connection termination, to the called SIP terminal 30 (step 53).

1 **[0039]** Then, the called SIP terminal 30 transmits a message (200 OK) for accepting connection
2 termination, to the call agent 20 (step 54), and the call agent 20 transmits a message (200 OK) for
3 accepting connection termination, to the calling SIP terminal 10, so that communication is
4 terminated (step 55).

5 **[0040]** Fig.2 is a drawing for one embodiment of a method for network address translation and
6 session management according to the present invention, showing procedure for a call process in case
7 that a call originates from a calling SIP terminal. Here, a reference numeral 100 stands for a calling
8 SIP terminal connected to the external public network, a reference numeral 200 stands for the NAT
9 block for receiving a SIP message transmitted from the calling SIP terminal 100, and performing
10 address translation and session management for the calling SIP terminal in the internal SIP, and
11 reference numerals 310 through 330 stand for a plurality of call agents constituting the local network
12 with the NAT block 200, for being responsible for the call process.

13 **[0041]** On the first place, as shown in Fig.2, the steps 401 through 402 of receiving a call
14 establishment request message generated from a calling SIP terminal 100 connected to the external
15 public network, extracting a public network address from the received call establishment request
16 message, storing the same, selecting a specific call agent among a plurality of call agents, storing a
17 communication path for the specific call agent in session information of the relevant call, and the
18 step 403 of distributing traffic by transmitting a SIP message transmitted from the calling SIP
19 terminal 100, to the selected call agent only, using information stored in session of the relevant call,
20 and the general steps 404 through 416 of processing a SIP call, and the step 417 of deleting session
21 if the first call process is completed, and the steps 418 through 420 of, if the second call

establishment request message is received, extracting a public network address from the received call establishment request, storing the same, selecting a specific call agent among a plurality of call agents, storing a communication path for the specific call agent in session information of the relevant call, distributing traffic by transmitting a SIP message transmitted from the calling SIP terminal 100, to the selected call agent only, using information stored in session of the relevant call, are provided.

[0042] Call process operation in the NAT block 200 upon originating of a call from the calling SIP terminal 100 of the present invention having the foregoing construction will be described in more detail as follows.

[0043] The SIP terminal 100 connected to the external public network puts a public network address of the terminal into “Via” and “Contact” fields of an INVITE message, transmitting the same to the NAT block 200 (step 401).

[0044] The NAT block 200 which receives the INVITE message judges the beginning of a call, generating one session for a call using a “CallID” (call identification) value. Also, the NAT block 200 stores, in the relevant session, a public network address and a UDP port of the calling SIP terminal 100 in order to give a response to the external calling SIP terminal 100.

[0045] If the public network address and the UDP port are stored, one call agent (*e.g.*, 310) among a plurality of call agents 310, 320, 330 constituting the local network is selected and address information for the selected call agent is stored in the generated session (step 402) and the relevant message is transmitted to the selected call agent 310 (step 403).

[0046] Subsequently, the selected call agent 310 transmits a “100 Trying” message informing a process for a call, to the NAT block 200 (step 404), and the NAT block 200 transmits a “100 Trying”

1 message to the public network address and the UDP port of the external calling SIP terminal 100
2 stored in the generated session(step 405).

3 **[0047]** As the steps 406 through 412 after that, are the same as the process procedure of the related
4 art shown in Fig.1, description thereof will be omitted.

5 **[0048]** Namely, in the steps 406 through 412, session of the relevant call is searched with use of
6 “CallID” for all the messages transmitted from the calling SIP terminal 100, and a call agent stored
7 in the session is searched and all the SIP messages are transmitted to the call agent 310 selected upon
8 beginning of a call.

9 **[0049]** If the calling SIP terminal 100 transmits a “BYE” message to release a call after a call is
10 completed (step 413), the NAT block 200 searches a call agent 310 stored in the session of the
11 relevant call, informs the call agent 310 of a call release request (step 414), receives a “200 OK”,
12 which is a response thereto, from the call agent (step 415), and transmits the same (“200 OK”) to the
13 calling SIP terminal 100 (step 416).

14 **[0050]** After that, the session where all information for the relevant call is stored, is deleted (step
15 417).

16 **[0051]** If the NAT block 200 receives an “INVITE” message of the second call after the first call
17 is terminated (step 418), the NAT block 200 selects a new call agent 320 for uniform distribution
18 of a call (step 419), processing the relevant call by transmitting the “INVITE” message to the
19 selected call agent 320, (step 420).

20 **[0052]** Fig.3 is a drawing for another embodiment of a method for network address translation and
21 session management according to the present invention, showing procedure for a call process in case

1 that a call terminates to a called SIP terminal.

2 **[0053]** Here, reference numerals 310,320,330 stand for a plurality of call agents responsible for
3 call process, and the NAT block represented by a reference numeral 200 is connected to a plurality
4 of the call agents 310,320,330 through the local network.

5 **[0054]** Also, a reference numeral 200 stands for the NAT block for performing address translation
6 and session management for a SIP message received from the call agents 310,320,330 existing in
7 the local network by interfacing the external network, and a reference numeral 110 is connected to
8 the NAT block, and stands for a called SIP terminal connected to the external public network.

9 **[0055]** In the above, the called SIP terminal 110 is actually the same as the calling SIP terminal
10 100 in Fig.2 and different reference numeral and terminology are used for discriminating between
11 a call originating operation and a call terminating operation.

12 **[0056]** In the first place, the call agents 310,320,330 in the called side inserts a local private
13 network address of the relevant call agent (*e.g.*, a call agent corresponding to 310), into a “Via” field
14 and “Contact” field of an INVITE message in order to initiate a terminated SIP call, transmitting the
15 same to the NAT block 200 (step 501-step 502).

16 **[0057]** The NAT block 200 which receives the INVITE message, generates session for the
17 relevant call using “CallID”, and changes the local private network address of the “Via” field and
18 the “Contact” field within the “INVITE” message, into a public network address of the NAT block
19 200 (step 503).

20 **[0058]** Subsequently, the NAT block 200 transmits an “INVITE” message to the called SIP
21 terminal 110 of the external public network, storing, in the relevant session, address information of

1 the call agent 310 that transmits the local private network address and the “INVITE” message (step
2 504).

3 **[0059]** In response to a “100 Trying” message received from a Session Initiation Protocol (SIP)
4 terminal 110, the NAT block 200 changes “Nia” and “Contact” fields into the local private network
5 address, which is stored in the session upon receipt of the “INVITE” message from the call agent 310
6 in step 502, and transmits the “100 Trying” message to the call agent 310 stored in the session.

7 **[0060]** After that, the step 507 through step 513 are the same as the call process procedure of the
8 related art shown in Fig.1, so that detailed description thereof will be omitted.

9 **[0061]** Namely, the steps 507 through 513 change all the messages transmitted from the external
10 called SIP terminal 110, into the public network address of the NAT block 200, and transmitting the
11 same.

12 **[0062]** If the call agent 310 transmits a “BYE” message to the NAT block 200 in order to release
13 a call after a call is completed (step 514), the NAT block 200 changes the local private network
14 address within the “BYE” message, into the public network address of the NAT block 200,
15 transmitting the same to the called SIP terminal 110 (step 515).

16 **[0063]** The called SIP terminal 110 which receives the “BYE” message, informs the NAT block
17 of a normal call release by transmitting a “200 OK” message to the NAT block 200 (step 516), and
18 the NAT block 200 which receives the “200 OK” message, transmits the “200 OK” message to the
19 call agent 310 stored in the relevant session (step 517), deleting all information and session for the
20 relevant call (step 518).

21 **[0064]** The present invention can be realized as computer-executable instructions stored in

1 computer-readable media. The computer-readable media includes all possible kinds of recording
2 media in which computer-readable data is stored. The computer-readable media include storing
3 media, such as magnetic storing media (*e.g.*, ROMs, floppy disks, hard disk, and the like), optical
4 reading media (*e.g.*, CD-ROMs (compact disc-read-only memory), DVDs (digital versatile discs),
5 re-writable versions of the optical discs, and the like), system memory (read-only memory, random
6 access memory), flash memory, and carrier waves (*e.g.*, transmission via the Internet). Also, the
7 computer-readable media can store and execute computer-readable codes that are distributed in
8 computers connected via a network.

9 **[0065]** As is apparent from the foregoing, the system and method for network address translation
10 and session management according to the present invention, could include more than one call agent
11 for a packet exchange system, by applying the NAT using the SIP to a packet exchange system for
12 supporting VoIP (Voice over Internet Protocol) using the SIP in the packet network, and thus much
13 more traffic could be processed compared to the method of the related art.

14 **[0066]** Also, the system and method for network address translation and session management
15 according to the present invention gives a private network address to the call agents in the local
16 network, giving a public network address to the NAT, thereby properly distributing the SIP call input
17 to the NAT from the external network, to the call agents in a plurality of local networks.

18 **[0067]** Also, one call agent connected through the first Call ID processes a call from its beginning
19 to its ending, so that the call agents in the local network could process much more calls.

20 **[0068]** While the invention has been shown and described with reference to certain preferred
21 embodiments thereof, it will be understood by those skilled in the art that various changes in form

1 and details may be made therein without departing from the spirit and scope of the invention as
2 defined by the appended claims.